Activity: Chemistry Fact or Fiction?

FOR THE TEACHER

Summary
In this activity, students will read a short article, view a video, and discuss why they believe the article and video are or are not reliable sources of information. Students will then perform a basic laboratory experiment implementing the steps of the Scientific Method.

Grade Level
High school

Objectives
By the end of this lesson, students should be able to
- identify indicators as to whether an article or video is reliable.
- realize not all information found on the internet or media is always true.
- describe a reason for a given conclusion using evidence from an investigation.
- apply the Scientific Method to an investigations.

Chemistry Topics
- Scientific Method
- The Nature of Science

Time
Teacher Preparation: 15 minutes
Lesson: 50-60 min

Materials
- 10-15 water marbles per lab group (Jelly marbles from stevespanglerscience.com)
- 400 mL beaker for each group (Large enough for students to reach into to obtain water marbles)
- Water to fill each beaker ¾ full
- 1 penny per lab group
- Disposable pipet
- 50 or 100 mL beaker containing tap water
- Water marbles abstract (for article fact vs fiction review)
- Water marbles video (for video fact vs fiction review)

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students should wash their hands thoroughly before leaving the lab.
- When students complete the lab, instruct them how to clean up their materials and dispose of any chemicals.
**Teacher Notes**

*Part 1: Fact vs Fiction*

- Teachers may want to share this [background information](#) for indicators of good vs. bad science.
- A video resource: *When Science Fiction becomes Science Fact*.
- Since this lesson is done at the beginning of the course, give students time to discuss and share their ideas with one another. Promote student discussion; be patient.
- Water marbles are purchased from [Steve Spangler Science](#). Place 10-15 in a 500 mL beaker the day prior to the activity.
- Have water marbles ready for after reading/video sections to allow students to interact with water marbles directly. Students will be curious and want to try. Ask them questions like: Where have you used substances like water marbles before? (Bathroom toys expand/grow in water); Why can’t you see the water marbles in the water? (The marbles become invisible due to an identical index of refraction with the liquid.)
- The fiction: [Further explanation](#) about water marbles in the video being a hoax.
- Teachers could use this Fact vs Fiction template with other resources/article/videos throughout the year.

*Part 2: Penny Drop Lab (implementing the steps of the Scientific Method)*

- This is a good lab for the beginning of the school year to have students recall the steps of the scientific method, and gain familiarity with teacher expectations for writing a lab report.
- The Scientific Method steps my district implements in Elementary/Middle School are: Question, Hypothesis, Procedure, and Conclusion. However, when students reach Chemistry as 10-12th graders, students need to be re-trained to write hypothesis statements and thorough conclusions.
- Hypothesis is an “if, then” statement. The “if” portion should restate what the student will do in the lab, and the “then” portion should state what the student expects to find. This can be strengthened by asking students to also justify their hypothesis with short a statement based on research or background knowledge.
- The laboratory question for this experiment is: How many drops of water can a penny hold? The hypothesis should be similar to: If water is placed on a penny, then it will hold _____ drops.
- The conclusion should require three important components: 1) Restate the hypothesis—can be copied; 2) A statement about what the student found/learned from the experiment (related to the hypothesis); 3) Data used to support student’s findings.

**Cross-Disciplinary Extensions**

**Connect to Math**
- Calculating an average.

**Connect to Reading**
- Reading the [background information](#) for indicators of fact versus fiction.
- Article reading and analysis for fact vs fiction.

**Connect to Writing**
- Redesign the procedure to reduce the variables and then perform the improved laboratory experiment in order to collect more reliable data.
Connect to Social Studies
- A video resource: When Science Fiction becomes Science Fact

FOR THE STUDENT

Lesson

Part 1: Chemistry Fact or Fiction?

Background
Chemistry is all around us, but it is our responsibility to determine whether or not what we see, read, or hear is really true. Today, we are constantly bombarded with YouTube videos, “news” articles on Facebook, Twitter, and other sources of information. Do you believe everything you read, see, or hear? How do you determine whether or not something is “real”?

To begin you will read an excerpt from an article, and then watch a video. Both of these sources can be chemistry fiction, chemistry fact, or one of each. Your job will be to decide how to categorize each item. Be prepared to discuss your reasoning.

Article Review: I believe the article is chemistry fiction or chemistry fact:
Provide three reasons to support your decision:
- 
- 
- 

Share: With a partner, discuss your position and supports. Be prepared to share your conversation with the class.

Video Review: I believe the video is chemistry fiction or chemistry fact:
Provide three reasons to support your decision:
- 
- 
- 

Share: With a partner, discuss your position and supports. Be prepared to share your conversation with the class.

Reflection: Based on the class discussions, do you maintain your original positions about the article and video being chemistry fiction or fact? Why or why not?
Part 2: The Penny Drop Lab

Background
As learned from the introductory activity, good chemistry must follow certain standards which have been agreed upon by the scientific community. Early in your science experiences, the Scientific Method was introduced as consisting of Question, Hypothesis, Procedure, and Conclusion. Today, you will perform the following lab using the Scientific Method.

Materials
- 1 penny
- Pipet
- 50 mL beaker
- Water

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow your teacher’s instructions for how to clean up your materials upon completion.

Problem
How many drops of water can a penny hold?

Hypothesis
Write your own hypothesis below in the format of an “If, then” statement.

Procedure
1. Obtain a penny, a 50 mL beaker, and a pipet.
2. Fill the beaker half full with water.
3. Using the pipet, draw water from the beaker.
4. Place the pipet very close to the penny, and release water slowly, drop by drop onto the surface of the penny.
5. Count the number of drops of water the penny can hold until water spills from the surface of the penny.
6. Record the number of drops in the data table below.
7. Repeat this process two more times.
8. Sketch the view from the top of the penny and from the side of the penny when it is holding water in the observation data table below.

Data

<table>
<thead>
<tr>
<th>Trial #</th>
<th># of Drops on Penny</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Observations
Draw pictures of the penny holding the water:

<table>
<thead>
<tr>
<th>Top view</th>
<th>Side View</th>
</tr>
</thead>
</table>

Analysis
1. Share your average value with the teacher. Compare the average values from your entire class on the board. Using the terms control and variable, provide an explanation as to why the values from each lab group may or may not be the same.

2. Did your penny hold more, less, or exactly the amount of water you predicted?

3. Identify at least three variables in this experiment.

4. How many controls should be used in a lab? How many variables in a lab?

5. Why did the penny hold as much water as it did? Refer to the article read earlier in class about water marbles.

6. Provide three reasons as to why this laboratory is consistent with chemistry fact and not chemistry fiction.

Conclusion
Make a conclusion statement based on the procedure you completed today. Remember to include the following three components in your conclusion:
- Restate the hypothesis—can be copied;
- Make a statement about what was found/learned from the experiment relating to the hypothesis);
- Include data to support your statement.